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ABSTRACT

A National Science Foundation (NSF)-funded study of beginning science and mathematics teachers in five countries looked at teacher induction systems that are more comprehensive than most in the United States. For example, the New Zealand system provides beginning teachers with paid release time, during which diverse sources of support offer the beginning teachers a repertoire of induction activities. Induction includes attention to science-specific needs such as development of science courses or lessons and hands on instruction. Facilitated peer support plays an important role. (Author/NB)

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Comprehensive Teacher Induction in Five Countries: Implications for Supporting U.S. Science Teachers

Edward Britton and Senta Raizen

Edward Britton, associate director of the National Center for Improving Science Education at WestEd, was co-principal investigator of a recent National Science Foundation–funded study of teacher induction abroad and project director of an international study of high school exit examinations for mathematics and science. He contributed to the science curriculum component of the Third International Mathematics and Science Study and coordinated U.S. participation in an international study of innovations in mathematics and science education through the Organization of Economic Cooperation and Development. He started out in education by teaching science in a junior-senior high school.

Senta Raizen, director of the National Center for Improving Science Education at WestEd, led a National Science Foundation–funded study of teacher induction in other countries. She served on the international steering committee for the Third International Mathematics and Science Study (TIMSS) and co-authored major TIMSS reports. She was principal investigator for an international comparison of high school examinations in mathematics and science, and an international study of innovations in mathematics and science education. Raizen has edited or contributed to over 50 books and written more than 100 articles in the fields of science, mathematics, and technology education.

Educators around the world are realizing that helping new teachers learn more about teaching is an important investment, one that can yield enhanced instruction throughout a teacher's career. From interviews with many of our colleagues from the Third International Mathematics and Science Study (TIMSS), we learned that most had weak or no teacher induction programs in their countries; however, they had a rapidly growing conviction of the need to strengthen the learning of their beginning teachers. U.S. educators and policy makers are also beginning to get the message that novice teachers need more than just a two-day orientation workshop (Britton et al. 2000).

Some countries are ahead of the game in providing more comprehensive teacher induction. WestEd's National Center for Improving Science Education and Michigan State University examined how five countries—France, Japan, New Zealand, Switzerland, and China (specifically, the city of Shanghai)—provide new middle and high school science and mathematics teachers with substantial, ongoing support (Britton et al. 2002). The three-year study was funded by the National Science Foun-

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dation. All five countries have support systems for novice teachers that have been established for 10 or more years; New Zealand's system, which has been in place for 25 years, is the oldest among the five countries' systems.

Comprehensive Induction: Meeting the Many Needs of Beginning Teachers

Addressing the many needs of beginning teachers requires a lot of effort, by a lot of people having different roles and expertise, using a variety of activities tailored to the novices' needs. This tall order is rarely filled around the world, even though research has long documented that novices come with a very wide range of needs. Most induction programs tackle only some kinds of needs—most commonly, helping to improve classroom management or orienting teachers to their school's facilities and procedures.

While induction systems in the studied countries also include the important kinds of support mentioned above, they go beyond support to offer the elements of comprehensive induction programs (as listed in Table 1). They also launch novice secondary teachers into early career learning; for example, they offer detailed understanding of how to plan and teach lessons in their subjects, how to assess student understanding, and how to work with parents. They also promote reflection on teaching, thereby encouraging continuous learning throughout a teacher's career.

Table 1 illustrates the distinctions between what we term "limited" and "comprehensive" teacher induction programs. It is obvious that to address effectively the many diverse needs of beginning teachers, education systems need to commit more effort, more resources, more participation by all sectors of the system, more kinds of people, more kinds of activities, more time in the year, and a longer period of time than traditional induction programs offer.

Illustrating Comprehensive Induction: School-based Induction in New Zealand

The universal experience of beginning teachers is to encounter pitfalls at every turn. But in many New Zealand schools, beginning science teachers also find help in every direction (Britton, Raizen, and Huntley 2002). New Zealand's national ministry of education requires that schools give first-year teachers 20 percent paid release time, and the ministry provides the funds for it. Typically, that means new teachers are assigned four classes rather than five, which gives them three to five more free periods a week than their more experienced colleagues. In 2002, the government strengthened the induction program by extending 10 percent release time to second-year teachers. And unlike in the United States, new teachers in New Zealand are usually not assigned to the most difficult classes. In addition, all schools in New Zealand must develop an Advice and Guidance (AG) program for their first- and second-year teachers (Moskowitz and Kennedy 1997; Teacher Registration Board 1993, 1997).

Table 1: Key Features of Limited versus Comprehensive Teacher Induction Programs

Program Feature	Limited Induction	Comprehensive Induction
Goals	Focuses on teacher orientation, support, enculturation, retention	Also promotes career learning, enhances teaching quality
Policies	Provides optional participation and modest time, usually unpaid	Requires participation and provides substantial, paid time
Overall program design	Employs limited number of ad hoc induction providers and activities	Plans an induction system involving a complementary set of providers and activities
Induction as a transitional phase	Treats induction as an isolated phase, without explicit attention to teachers' prior knowledge or future development	Considers influence of teacher preparation and professional development on induction program design
Initial teaching conditions	Pays limited attention to initial teaching conditions	Pays attention to assigned courses, students, non-teaching duties
Level of effort	Invests limited total effort, or all effort, in few providers, activities	Requires substantial overall effort
Resources	Does not provide resources sufficient to meet program goals	Provides resources sufficient to meet program goals
Levels of education system involved	Involves some levels of the system, perhaps in isolation	Involves all relevant levels of system in articulated roles
Length of program	One year or less	More than one year
Sources of support	Primarily or solely uses one mentor	Uses multiple, complementary induction providers
Conditions for novices/ providers	Usually attends to learning conditions for novices	Also provides conditions and training for providers
Activities	Uses a few types of induction activities	Uses a set of articulated, varied activities

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Figure 1 illustrates that beginning teachers in New Zealand receive help from many sources, especially within their schools but also from outside. Novice science teachers are assigned one primary mentor, usually the science department head. Department heads formally and informally observe beginners' classes, hold one-on-one meetings with them, permit beginners to observe their teaching, arrange for novices to observe other teachers, and alert them to professional development opportunities outside the school.

Every school has an AG coordinator, usually a deputy principal, who is the novices' second main source of support. As administrators, the coordinators have flexible schedules that allow them to meet with beginning teachers for one-on-one meetings whenever the novices have free periods. Coordinators also bring together new teachers on a regular basis, typically every two weeks, to grapple with whatever practical, emotional, or other needs the teachers are facing. Thus, beginning teachers help each other through these facilitated peer support meetings.

Buddy teachers usually are another secondary source of support, and their roles vary. Some buddy teachers help substantively—for example, by observing novices' classes and offering advice. But they can also provide more basic assistance. As one coordinator noted, "I assign a buddy teacher who lives nearby and can give them a ride if need be, bring some work home to them if they're sick, etc."

Although not a formal part of the induction program, other staff members in New Zealand schools also support beginning teachers; these include other science teachers, science department laboratory technicians, and teachers in other subjects. The most common way that other science teachers help is through informal means such as conversations at "interval" and lunchtime. All secondary schools have a 15–20-minute interval in the morning when the entire school faculty comes to the faculty lounge for coffee and refreshments while the pupils have a recess. In our school visits, it appeared that over 90 percent of the teachers regularly show up for these collective breaks. As a result, new teachers have a chance to briefly discuss anything on their minds with virtually any other teacher. A similar phenomenon occurs at lunchtime, although less so because attendance is lower (about 50–80 percent). Beyond the school, regional science advisors and leaders of workshops or short courses at colleges and universities also aid novices.

The following comments by one second-year teacher illustrate the support found by novices in New Zealand.

> *Four people were especially helpful last year. Dorothy [her department head] was brilliant. Any questions and I'd go straight in and ask, and she was happy to answer. I still do. The second person was Glenda [her buddy teacher], the biology teacher next door. She was the first line of attack because she was next door. I'd run across to her and she was full of advice. The third was Irene, who helped me with astronomy and geology. Mr. Hastings [her AG coordinator] absolutely was looking out for me, and the meetings he ran for all of us [begin-*

Figure 1. Support Providers for Beginning Secondary Science Teachers in New Zealand

[1] Usually a deputy principal.
[2] Sometimes an experienced teacher.
[3] Often an accomplished, early career teacher.
[4] Usually through faculty coffee breaks, department meetings, or impromptu interactions.
[5] Depends on disposition of science department lab technician.
[6] Science teachers in other schools, regional advisors, workshops, courses.

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ning teachers in the school] were really valuable. Officially, Dorothy and Glenda were assigned to me by Mr. Hastings. But with Irene, it just turned out that she was a lot of help to me too.

One aspect of the New Zealand educational system that makes beginning teacher support programs effective is a commitment throughout the educational system to beginning teacher support. Players at all levels of the system assume that new teachers have particular needs and, therefore, that the system must pay explicit attention to addressing them. Many new teachers state that they feel free to approach most anyone in their department for advice. For example, new teachers feel they can ask other teachers to drop in to see how they teach some specific topic or activity. This strong culture of support makes it easier to implement beginning teacher support programs and activities.

In all five countries studied, induction programs coordinated support from multiple sources. Most support in New Zealand was within-schools because there are no school districts in the country; each school interacts directly with the national ministry of education. In other countries, school districts, district or regional professional development centers, and/or teacher preparation institutions also played a strong role in teacher induction. Such induction systems are organizationally complex, requiring coordination and articulation of induction activities across multiple levels of the education system.

Developing Science Courses, Lessons, and Hands-on Instruction

The general nature of the language of New Zealand's national science curriculum framework affords schools wide latitude in specifying the detailed topics to be taught and how to teach them. School science departments must devise their own agreements on the curriculum of each science course, particularly in the lower secondary grades (eight and nine). Departments, for each science unit, compile and continually update instructional ideas and resources, or even lesson plans. However, teachers have the freedom to choose among the available lessons and resources, and also to create their own. Textbooks generally play a very minor role in most New Zealand science classrooms, serving as an infrequently used class resource rather than daily medium of instruction.

The quality and amount of a department's course specifications and locally developed curricular resources are strong influences on all teachers—and particularly on the new teacher. A strong syllabus and ample resources lay out an instructional course of action for beginning teachers and equip them to deliver it. In other schools, the yearlong course specifications are less detailed, necessitating that new teachers work on their own or in collaboration with others to flesh them out. Departments also vary in the extent to which details are on hand for how to teach the topics (e.g., what activities to use, what resources are available). Smaller science departments found in smaller schools, particularly rural schools, find it more challenging to mar-

shal such specific curricular guides. Any new teacher entering a school as its lone science teacher would be extremely hard-pressed to create a strong science course if his or her predecessor did not leave one behind.

The New Zealand science curriculum emphasizes investigation through hands-on experiences, referred to as "practicals." Hands-on science is emphasized particularly in the integrated science courses of grades eight to ten. Over 80 percent of the lessons we observed engaged pupils in activities during 70–95 percent of the class period. Coping with active learning in hands-on science adds layers of complexity to the general learning challenge of a beginning teacher. For example, it requires learning how to effectively use science supplies and apparatus with pupils, which is quite different from how teachers used them in their college science courses. Fortunately, the existence of science laboratory technicians in New Zealand schools reduces the need to learn how to acquire and assemble supplies and to spend time doing this. Even so, the following comments by a deputy principal express a common perception that beginning science teachers have a lot to learn about teaching science:

> *It's important to remember that the universal experience of new teachers of needing more time is compounded for new science teachers. They have to become familiar with new materials, equipment, facilities, etc., needed for the practicals. Teachers need to run experiments themselves beforehand if they aren't familiar with them in order to see what happens.*

Implications for Supporting U.S. Science Teachers

1. *Help beginners with planning science courses and lessons.* Planning one or a few sample science units during even an excellent preservice program cannot fully prepare beginning science teachers for the entirety of planning science courses and lessons. Remember that beginners are asking the following questions for the first time: Exactly what science topics will I teach tomorrow, next week, and next month, and how will I teach them? On my first day of teaching (Britton), I asked my principal just what science topics to teach for each of the five science courses that he had assigned to me. His only answer was to hand me a pile of textbooks. None of the other four science teachers offered any guidance.

   Support providers need to help novices determine the details of the science curriculum for a semester or yearlong course (or, worse yet, several courses), the lessons that would best fulfill unit goals, what school resources are available for them, and the strengths and weaknesses of the students they are teaching. Induction programs sometimes fail to include such teacher learning, incorrectly assuming that when it comes to a secondary teacher's subject, no help is needed.

   Beginners' needs for help in developing their science curriculum may be particularly acute in these types of schools: (a) small schools where they are one of a few science teachers or the only one; (b) larger schools where the science departments leave almost all curriculum and lesson planning to individual teachers;

(c) schools with poorly prepared students; and (d) textbook-oriented schools where dependence on texts can deter implementation of inquiry-oriented teaching.

2. *Help beginners learn about instructional resources and methods for inquiry-based teaching*. If U.S. science education is ever to fulfill the vision of inquiry teaching called for by the National Science Education Standards, induction programs will need to help new science teachers get started. If class time is to be spent on *doing* science in addition to knowing science facts, more time and effort will have to be spent on how to prepare, execute, and follow up inquiry-based lessons. That's a tremendous challenge for a new science teacher. Since U.S. schools do not have science department laboratory technicians like those in New Zealand (and other countries such as Australia and the U.K.), who is going to help novice science teachers accomplish this?
3. *Avoid being the lone support provider*. If you participate in an induction program that formally assigns the entire responsibility for mentoring a beginning teacher to you, recognize that you inherently have been charged with something that is rarely attainable. Given the very wide range of beginning teachers' needs, why would one expect a single individual to have the background, experiences, and personality that can be effective for addressing them all? Make a list of all your novice's needs, including subject-specific issues, and decide which ones you have the background or circumstances to address. Try to enlist, informally if need be, additional faculty or administrators who can better address the other needs in coordination with you.

   If the design of the induction program in your school or district makes it difficult to enlist others, at least strike a balance among your expectations of what you are likely and unlikely to achieve. Take encouragement from knowing that whatever you are able to do will help novices' early career learning much better than if they had to go it alone. Don't avoid the charge because the scope of it seems overwhelming. Identify the most important, doable strategies, and dive in.
4. *Promote a faculty culture of supporting beginning teachers*. Related to the previous suggestion, while the strong colleague culture among faculty in New Zealand schools is rather rare in U.S. schools, consider prodding your peers toward such a mindset and environment. Do not view this suggestion as adding yet one more item to the already long list of support provider activities. Whatever successes you have in promoting a supportive culture will only benefit your ability to carry out your own work in supporting novices, since more colleagues will be inclined to help you.
5. *Don't overlook the role of peer support*. Facilitated peer support activities strongly meet some beginners' needs that cannot be addressed well by mentors. Among the many types of support activities we encountered in New Zealand, we were struck by the importance of "facilitated peer support." We use this term for the frequent meetings when administrators convene all the beginning teachers in the school or the special day(s) when the regional advisory service convenes beginning teachers from many schools.

In our study of Swiss science teacher induction, we encountered another version of facilitated peer support (Raizen, Huntley, and Britton 2002). School districts organized regular "practice groups" of beginning teachers from different schools, where counselors facilitated the novices' problem solving around substantive teaching issues they were encountering. The counselors are carefully selected and extensively trained; providing professional development for support providers is an aspect of the induction system that was surprisingly weak in New Zealand and some other countries' induction systems. In the Swiss approach, novices also visited each other's schools to observe and provide feedback on their peers' teaching, as did their experienced teacher-mentors.

The U.S. field of teacher induction often places an emphasis on providing support through experienced teachers who use mentoring or other induction activities. However, the facilitated peer support activities in New Zealand and Switzerland address important needs that those other induction strategies are less able to fulfill—providing opportunities for beginners to more candidly express their needs and describe their experiences. Further, meeting with peers in other subjects enriches novices' perspectives about several aspects of teaching. Meetings in which teachers come from different schools provide even more safety for disclosure than the within-school meetings. The exchanges about induction experiences also diversify the participants' expectations of the kinds of support they might request or expect from their other support providers.

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